

### **V-LAB KITS AND EXPERIMENTS**

V-Lab experiments are designed to be age appropriate, and to reinforce key concepts as outlined in the core curriculum standards. Kits contain all supplies needed (except water) for each student in a classroom of 30 students to conduct the experiment. Kits contain plastic lab ware (beakers, pipettes, etc) and consumables as needed for each experiment. Extra consumables are included to allow the teacher to independently conduct the same experiment with additional 3 or 4 groups of students, thus reaching up to 150 students per experimental kit.

### **CURRENT V-LAB EXPERIMENTS**

S2S is in the process of developing 10-15 experiments for each of the following age groups – grades 4-6; grades 7 & 8; and grades 9-12. All of the experiments are designed to be interesting, clearly illustrative of a fundamental concept of STEM, safe, age appropriate, career oriented and supportive of the core curriculum. Where ever possible, experiments are designed as a plausible, real life scenario in a problem / investigation / solution format. Kits have been developed by S2S, which contain all materials required for each student to perform the experiment at their desktop. These kits are shipped to the teacher in advance and training is provided to teachers and in-class mentors. Grades 4-6 experiments are designed to excite students while introducing them to basic scientific experiments. Grades 7&8 experiments are designed to inspire and motivate students to pursue scientific electives in high school while introducing them to a variety of STEM career opportunities. Lastly, Grades 9-12 experiments present the students with a career related challenge and the opportunity to use the scientific method to design and attempt a scientific approach to solve a relevant problem. The following are examples of experiments which have been developed and implemented:

#### **Elementary School Experiments**

### **Mystery of M&M's**

Students will answer the question, "What happens when colored candies are placed in water? We will conduct experiments on M&M's and Skittles looking at the diffusion of pigments and sugar in water.

### **Candy Color Wheel: Mixing and Separating Colors**

Students will look at the formation and separation of secondary colors from primary colors using an M&M color wheel. They will mix colors using primary colored M&M's and water, then use paper chromatography to separate them again. They will also make a cardboard color wheel to observe the color mixing.

### **Curious Crystals**

In this activity, students will carefully look at known household crystals. After observing and describing the crystals, students will be given an unknown crystal which is chemically the same as one of the known crystals but looks different. Students will conduct a series of tests and will gather enough evidence to identify the unknown crystal.

### **Density Rainbow**

Most students are familiar with a rainbow which is produced by the sunlight shining through droplets of water suspended in the air. The rainbow takes the form of a multi-colored arc containing the seven colors. In this experiment, students are provided with pipettes, a concentrated solution of sugar, water and test tubes. Students make a series of dilutions by using a pipette to transfer sugar solution and water into test tubes containing different color food coloring to make different concentrations. After some practice, students build a density tower by slowly dripping each solution down the side of the tube. Students get excited when they are given the opportunity and encouragement to explore questions such as, what happens when I change the order or if I shake up the solutions?

### **Middle School Experiments**

#### **CO<sub>2</sub> to the Rescue! – Using a chemical reaction to save a cell phone.**

This lesson begins with a design challenge to invent a small device that could rescue a cell phone that accidentally falls into water. A self-inflating balloon might be able to act as a flotation device to keep a cell phone from sinking or bring it up after it sinks. Students conduct a pair of chemical reactions to determine which of two acids react with baking soda to produce the most carbon dioxide gas and apply this to the flotation problem.

#### **Chemistry's Colorful Clue! □ Using chemistry to solve a mystery**

This lesson begins with a scenario in which students monitoring a stream realize that the water has become acidic. They do not see anything to indicate how it happened. Students conduct activities to learn basic concepts about acids, bases, and indicators while trying to solve a mystery of how the stream presented in the story became acidic.

### **Glow it Up! Exploring Chemical Reactions that Glow**

This lesson explores chemical reactions that release energy in the form of light known as chemiluminescence. Students will conduct an experiment to see how the amount of oxidizer affects the brightness and duration of the light. The lesson title, "Glow It Up!", refers to the idea that using a light stick in an emergency situation can prevent explosions. At the end of the lesson, students will learn the light sticks are often stored in emergency kits, so that if they ever are needed, people can "glow it up" rather than "blow it up".

### **Catch a Thief**

The S2S Crime Lab has been tasked by the FBI to help identify a thief who has been forging checks in amounts of \$1,000 or more. While the FBI knows in which office the thief works, they don't know who it is. They need a chemist to characterize the ink used in the signature and in each pen used in the office to look for a match.

### **High School Experiments**

### **Production of a Gas**

Students will learn about the gases that erupt from volcanoes and the volcanologists who study them. They will study the production of carbon dioxide and the chemistry behind the reaction.

### **Acid/Base Reactions using Indicators**

Students will gain an understanding of how acid rain and greenhouse gas affect the earth's water supply. They will also learn how botanists and marine chemists study the pH changes in soil and water sources.

### **Forming a Precipitate**

Students will learn about water purification techniques through precipitation of contaminants to gain an understanding of how environmental scientists work to improve water quality.

### **Exothermic and Endothermic Chemical Reactions**

Students will learn how chemical reactions that cause temperature change can be used for practical applications. They will also learn how industrial scientists, engineers and chemists can make useful products from the reaction of simple chemicals.

### **Quality Control Test for Polymers**

The S2S Analysis Lab in East Hanover, NJ has been tasked by the Federal Aviation Administration (FAA) to help in developing a point-of-use analytical test for qualifying high-performance polymer raw materials used in turbine engine manufacturing. Students develop a method for determining its density using a sugar density tower.